Scott N. Walck

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105 East High Street
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EXPERIENCE

2010–present	Professor of Physics, Lebanon Valley College
2011–2019	Chair, Department of Physics, Lebanon Valley College
2013	Honorary Senior Research Fellow, Computing Science, Univ. of Glasgow
2004–2010	Associate Professor of Physics, Lebanon Valley College
2005–2006	Visiting Scholar, Dept. of Mathematics, Univ. of Pennsylvania
1999–2004	Assistant Professor of Physics, Lebanon Valley College
1997–1999	Postdoctoral Fellow, University of Rochester
1995–1997	Research Associate, Naval Research Laboratory
1990–1995	Teaching Assistant and Research Assistant, Lehigh University
1988–1990	Electrical Engineer, Lutron Electronics Company

EDUCATION

Doctor of Philosophy in Physics, 1995
Lehigh University, Bethlehem, PA

Master of Science in Physics, 1992
Lehigh University, Bethlehem, PA

Bachelor of Science Cum Laude in Electrical Engineering, 1988
Rensselaer Polytechnic Institute, Troy, NY

COLLEGE COURSES TAUGHT

Introductory Physics I,II (Algebra-based)
Introductory Physics I,II (Calculus-based)
Computational Physics
Differential Equations
Meaning of Quantum Theory
Classical Mechanics II
Electromagnetic Theory I,II
Quantum Mechanics I,II
General Relativity
First Year Seminar

Quantum Mechanics, first-year graduate level (University of Rochester)

AWARDS

- Thomas Rhys Vickroy Distinguished Teaching Award (2009) from Lebanon Valley College
- 2024 Most Promising New Textbook Award from the Textbook and Academic Authors Association

RESEARCH GRANTS AWARDED

David W. Lyons and Scott N. Walck, "RUI: Structure and Local Equivalence of Stabilizers and States," National Science Foundation, 2012–2015, $273,975.

Scott N. Walck and David W. Lyons, "RUI: Entanglement Classification via Stabilizers and Subsystem States," National Science Foundation, 2009–2012, $236,198.

Scott N. Walck and David W. Lyons, "RUI: Space of Multiparticle Entanglement Types," National Science Foundation, 2006–2009, $160,000.

Scott N. Walck, "Topology, geometry, and visualization of the pure three-qubit state space," Research Corporation, 2002–2005, $33,218.

COLLEGE SERVICE (Lebanon Valley College)

Faculty Advancement Committee, 2018–2019
Presidential Search Committee, 2011–2012
Faculty Colloquium Coordinator, 2004–2005, 2007–2012
Tenure and Promotion Committee, 2008–2011 (Chair 2010–2011)
Board of Trustees, 2008–2011
Faculty Grants Committee, 2004–2010
Curriculum Committee, 2006–2008 (Chair 2006–2007)
Strategic Planning Committee of the Board of Trustees, 2004–2008
Great Expectations Campaign, Science Initiative Committee, 2003–2008
VPAA Search Committee, 2005
Committee on Information Technology and Services, 2000–2005
Academic Evaluation and Policies Committee, 2000–2002

TEACHING-RELATED ACTIVITIES

Syllabi Reviewer, College Board AP Course Audit (2007).

AP Reader, College Board Advanced Placement Exam in Physics (2006).

Wye Faculty Seminar, Aspen Institute (2002).

Summer Faculty Workshop, *Using Computers in Intermediate and Advanced Undergraduate Physics*, Lawrence University (2001).

Chautauqua Short Course, *Promoting Active Learning in Introductory Physics Courses I*, Dickinson College (2001).

Workshop for New Physics Faculty, American Association of Physics Teachers (1999).

PUBLICATIONS

Book

Learn Physics with Functional Programming: A Hands-on Guide to Exploring Physics with Haskell, Scott N. Walck, No Starch Press, 2023, 648 pp., ISBN-13: 9781718501669, `https://lpfp.io/`

Refereed Articles

[1] Scott N. Walck, "Functional Programming in Learning Electromagnetic Theory," Electronic Proceedings in Theoretical Computer Science, **405**, 20 (2024). `https://dx.doi.org/10.4204/EPTCS.405.2`

[2] R. F. Malenda, S. Talbott, and Scott N. Walck, "The Micro Assignment Guided Inquiry and Collaboration (MAGIC) Method: A Qualitative Discussion of the Benefits of Active Learning Through Scaffolded Assignments in Upper-Level Physics and Mathematics," Journal of College Science Teaching, `https://doi.org/10.1080/0047231X.2024.2338696` (2024).

[3] David W. Lyons, Nathaniel P. Gibbons, Mark A. Peters, Daniel J. Upchurch, Scott N. Walck, and Ezekiel W. Wertz, "Local Pauli stabilizers of symmetric hypergraph states," Journal of Physics A: Mathematical and Theoretical, **50**, 245303 (2017).

[4] Scott N. Walck, "Learn Quantum Mechanics with Haskell," Electronic Proceedings in Theoretical Computer Science, **230**, 31 (2016).

[5] David W. Lyons, Daniel J. Upchurch, Scott N. Walck, and Chase D. Yetter, "Local unitary symmetries of hypergraph states," Journal of Physics A: Mathematical and Theoretical, **48**, 095301 (2015).

[6] Scott N. Walck, "Learn Physics by Programming in Haskell," Electronic Proceedings in Theoretical Computer Science, **170**, 67 (2014).

[7] Curt D. Cenci, David W. Lyons, and Scott N. Walck, "Local unitary group stabilizers and entanglement for multiqubit symmetric states," Lecture Notes in Computer Science, **6745**, 198 (2014).

[8] David W. Lyons and Scott N. Walck, "Entanglement verification using local unitary stabilizers," Phys. Rev. A **87**, 062321 (2013).

[9] David W. Lyons, Abigail M. Skelton, and Scott N. Walck, "Werner state structure and entanglement classification," Advances in Mathematical Physics **2012**, 463610 (2012).

[10] David W. Lyons and Scott N. Walck, "Symmetric mixed states of n qubits: Local unitary stabilizers and entanglement classes," Phys. Rev. A **84**, 042340 (2011).

[11] David W. Lyons and Scott N. Walck, "Entanglement classes of symmetric Werner states," Phys. Rev. A **84**, 042316 (2011).

[12] Curt D. Cenci, David W. Lyons, Laura M. Snyder, and Scott N. Walck, "Symmetric states: local unitary equivalence via stabilizers," Quantum Information and Computation **10**, 1029 (2010).

[13] Scott N. Walck and David W. Lyons, "Only n-qubit Greenberger-Horne-Zeilinger states contain n-partite information," Phys. Rev. A **79**, 032326 (2009).

[14] David W. Lyons and Scott N. Walck, "Multiparty quantum states stabilized by the diagonal subgroup of the local unitary group," Phys. Rev. A **78**, 042314 (2008).

[15] Scott N. Walck and David W. Lyons, "Only n-Qubit Greenberger-Horne-Zeilinger States Are Undetermined by Their Reduced Density Matrices," Phys. Rev. Lett. **100**, 050501 (2008).

[16] David W. Lyons, Scott N. Walck, and Stephanie A. Blanda, "Classification of nonproduct states with maximum stabilizer dimension," Phys. Rev. A **77**, 022309 (2008).

[17] Scott N. Walck and David W. Lyons, "Maximum stabilizer dimension for nonproduct states," Phys. Rev. A **76**, 022303 (2007).

[18] David W. Lyons and Scott N. Walck, "Classification of n-qubit states with minimum orbit dimension," J. Phys. A: Math. Gen. **39**, 2443 (2006).

[19] Scott N. Walck, James K. Glasbrenner, Matthew H. Lochman, and Shawn A. Hilbert, "Topology of the three-qubit space of entanglement types," Phys. Rev. A **72**, 052324 (2005).

[20] D. W. Lyons and S. N. Walck, "Minimum orbit dimension for local unitary action on n-qubit pure states," J. Math. Phys. **46**, 102106 (2005).

[21] M. Bayer, G. Ortner, O. Stern, A. Kuther, A. A. Gorbunov, A. Forchel, P. Hawrylak, S. Fafard, K. Hinzer, T. L. Reinecke, S. N. Walck, J. P. Reithmaier, F. Klopf, and F. Schäfer, "Fine Structure of Neutral and Charged Excitons in Self-Assembled In(Ga)As/(Al)GaAs Quantum Dots," Phys. Rev. B **65**, 195315 (2002).

[22] S. N. Walck and N. C. Hansell, "Characterization and Visualization of the State and Entanglement of Two Spins," Eur. J. Phys. **22**, 343 (2001).

[23] M. Bayer, A. Kuther, A. Forchel, T. L. Reinecke, and S. N. Walck, "Fine Structure of Excitons in Self-Assembled $In_{0.60}Ga_{0.40}As$ Quantum Dots: Zeeman-Interaction and Exchange Energy Enhancement," Physica E **7**, 475 (2000).

[24] M. Bayer, A. Kuther, A. Forchel, A. Gorbunov, V. B. Timofeev, F. Schäfer, J. P. Reithmaier, T. L. Reinecke, and S. N. Walck, "Electron and Hole g Factors and Exchange Interaction from Studies of the Exciton Fine Structure in $In_{0.60}Ga_{0.40}As$ Quantum Dots," Phys. Rev. Lett. **82**, 1748 (1999).

[25] S. N. Walck, T. L. Reinecke, M. Bayer, T. Gutbrod, J. P. Reithmaier, and A. Forchel, "Magnetic-Field Dependence of the Exciton-Photon Coupling in Structured Photonic Cavities," Phys. Rev. B **60**, 10695 (1999).

[26] M. Bayer, S. N. Walck, T. L. Reinecke, and A. Forchel, "Exciton Binding Energies and Diamagnetic Shifts in Semiconductor Quantum Wires and Quantum Dots," Phys. Rev. B **57**, 6584 (1998).

[27] S. N. Walck and T. L. Reinecke, "Exciton Diamagnetic Shift in Semiconductor Nanostructures," Phys. Rev. B **57**, 9088 (1998).

[28] M. Bayer, T. L. Reinecke, S. N. Walck, V. B. Timofeev, and A. Forchel, "Multiple Resonances involving Magnetoexcitons in a $GaAs/Al_{0.30}Ga_{0.70}As$ Quantum Well," Phys. Rev. B **58**, 9648 (1998).

[29] W. Braun, M. Bayer, A. Forchel, H. Zull, J. P. Reithmaier, A. I. Filin, S. N. Walck, and T. L. Reinecke, "Excitonic Wavepackets in $In_{0.135}Ga_{0.865}As/GaAs$ Quantum Wires," Phys. Rev. B **55**, 9290 (1997).

[30] T. L. Reinecke, P. A. Knipp, and S. N. Walck, "Optical Properties of Semiconductor Nanostructures," J. Vac. Sci. Technol. B **15**, 1040 (1997).

[31] M. Bayer, S. N. Walck, T. L. Reinecke, and A. Forchel, "Enhancement of Exciton Binding Energies in Quantum Wires and Quantum Dots," Europhys. Lett. **39**, 453 (1997).

[32] S. N. Walck, T. L. Reinecke, and P. A. Knipp, "Exciton Binding Energy in T-Shaped Semiconductor Quantum Wires," Phys. Rev. B **56**, 9235 (1997).

[33] S. N. Walck and W. B. Fowler, "Dynamic Bond-Strength Variation for Hydrogen-Donor Pairs in Semiconductors," Phys. Rev. B **51**, 13146 (1995).

Conference Proceedings

[1] S. N. Walck, "Topological Decomposition of Composite Quantum State Spaces," *Proceedings of the International Conference on Quantum Information*, edited by N. P. Bigelow, J. H. Eberly, C. R. Stroud, and I. A. Walmsley (Optical Society of America, 2001), paper EAPB4.

[2] M. Bayer, T. L. Reinecke, S. N. Walck, A. Forchel, and V. B. Timofeev, "Multiple Resonances of Magneto-excitons in GaAs/$Al_{0.30}Ga_{0.70}$As Quantum Wells," *High Magnetic Fields in the Physics of Semiconductors II*, edited by G. Landwehr and W. Ossau (World Scientific, 1997), p. 549.

[3] M. Bayer, A. Forchel, T. L. Reinecke, S. N. Walck, and V. B. Timofeev, "Binding Energy and Spin-Splitting of Excitons in $In_xGa_{1-x}As$/GaAs Quantum Dots," *High Magnetic Fields in the Physics of Semiconductors II*, edited by G. Landwehr and W. Ossau (World Scientific, 1997), p. 651.

[4] T. Gutbrod, M. Bayer, A. Forchel, S. N. Walck, T. L. Reinecke, M. Röhner, H. Zull, and J. P. Reithmaier, "Tuning of Rabi-Splitting by a Magnetic Field," *High Magnetic Fields in the Physics of Semiconductors II*, edited by G. Landwehr and W. Ossau (World Scientific, 1997), p. 663.

[5] W. Braun, M. Bayer, A. I. Filin, A. Forchel, H. Zull, H. P. Reithmaier, S. N. Walck, and T. L. Reinecke, "Coherent Spectroscopy of Freestanding InGaAs/GaAs Quantum Wires," in *Quantum Electronics and Laser Science Conference*, Vol. 12, 1997 OSA Technical Digest Series (Optical Society of America, Washington, D.C., 1997), p. 38.

[6] M. Bayer, S. N. Walck, T. L. Reinecke, and A. Forchel, "Dependence of Exciton Binding Energies on Reduced Dimension in Semiconductor Nanostructures," *23rd International Conference on the Physics of Semiconductors*, edited by M. Scheffler and R. Zimmermann (World Scientific, 1996), p. 1429.

PRESENTATIONS

[1] Scott N. Walck, "Typed Functional Programming and Physics," American Association of Physics Teachers Winter Meeting, Houston, Texas (January 14, 2019).

[2] Scott N. Walck, "Qubits and Entanglement," Susquehanna University (November 6, 2018).

[3] Scott N. Walck, "Learn Quantum Mechanics with Haskell," 5th International Workshop on Trends in Functional Programming in Education, College Park, Maryland (June 7, 2016).

[4] Scott N. Walck, "Qubits and Entanglement," Physics Colloquium, Franklin and Marshall College (April 5, 2016).

[5] Scott N. Walck, "Learn Physics by Programming in Haskell," Annual Meeting of the Mid-Atlantic Section of the American Physical Society, Pennsylvania State University (October 5, 2014).

[6] Scott N. Walck, "Learn Physics by Programming in Haskell," 3rd International Workshop on Trends in Functional Programming in Education, Soesterberg, Netherlands (May 25, 2014).

[7] Scott N. Walck, "Multi-particle entanglement classification," University of Glasgow (2012).

[8] Scott N. Walck, "Two examples of entanglement classification," Anacapa Society Meeting, Hamline University, St. Paul, Minnesota (2012).

[9] Scott N. Walck, "Local unitary stabilizers and multipartite entanglement," Plenary Lecture at the Symposium on Optical Interactions and Quantum Systems, University of Rochester (2009).

[10] Scott N. Walck and David W. Lyons, "Only n-qubit Greenberger-Horne-Zeilinger states contain n-partite information," 40th Annual Meeting of the APS Division of Atomic, Molecular and Optical Physics, Charlottesville, Virginia (2009).

[11] Scott N. Walck, "Classifying Quantum Entanglement Using the Local Unitary Group Action," Tetrahedral Geometry and Topology Seminar, Hempfield, PA (2006).

[12] Scott N. Walck, "Classifying Quantum Entanglement using the Local Unitary Group Action," University of Pennsylvania, Philadelphia, PA (2006).

[13] David W. Lyons and Scott N. Walck, "Simplified Method for Classification of Entanglement Types," Joint Mathematics Meetings (American Mathematical Society and Mathematical Society of America), Baltimore, MD (2003).

[14] Jon S. Pitt and Scott N. Walck, "Stationary Two-Qubit Quantum States," Joint Mathematics Meetings (American Mathematical Society and Mathematical Society of America), Baltimore, MD (2003).

[15] Scott N. Walck, "Quantum Computers and Quantum Entanglement," Muhlenberg College, Allentown, PA (2002).

[16] Scott N. Walck, "Bloch-Sphere-Based Visualizations of Quantum Systems," Gordon Conference on Physics Research and Education in Quantum Mechanics, Mount Holyoke College, South Hadley, MA (2002).

[17] Scott N. Walck, "Topological Decomposition of Composite Quantum State Spaces," International Conference on Quantum Information, Rochester, NY (2001).

[18] Scott N. Walck, "Peer Instruction at Lebanon Valley College," American Association of Physics Teachers Winter Meeting, Kissimmee, FL (2000).

[19] Scott N. Walck, "More than Four: States of a Two-Bit Quantum Computer," Lehigh University, Bethlehem, PA (2000).

[20] S. N. Walck and D. G. Hall, "Waveguide-Mediated Dipole-Dipole Interaction," Optical Society of America Annual Meeting, Baltimore, MD (1998).

[21] S. N. Walck and T. L. Reinecke, "Diamagnetic Shifts and Binding Energies of Excitons in Quantum Dots," Recent Advances in the Physics of Single Quantum Dots, Washington, DC (1997).

[22] S. N. Walck and T. L. Reinecke, "Exciton Diamagnetic Shift in Quantum Wires and Dots," March Meeting of the American Physical Society, Kansas City, MO (1997).

[23] M. Bayer, S. N. Walck, T. L. Reinecke, and A. Forchel, "Dependence of Exciton Binding Energies on Reduced Dimension in Semiconductor Nanostructures," 23rd International Conference on the Physics of Semiconductors, Berlin, Germany (1996).

[24] S. N. Walck and T. L. Reinecke, "Exciton Binding Energy in Quantum Wells, Wires, and Dots," March Meeting of the American Physical Society, St. Louis, MO (1996).

[25] S. N. Walck and W. B. Fowler, "Role of Lattice Interaction in the Vibration of Defect Complexes in Semiconductors," March Meeting of the American Physical Society, San Jose, CA (1995).

[26] S. N. Walck and W. B. Fowler, "Importance of a 3-Body Interaction in the Vibration of H-X Antibonding Complexes," Gordon Research Conference on Point and Line Defects in Semiconductors, Plymouth, NH (1994).

[27] S. N. Walck and W. B. Fowler, "Modeling Hydrogen Related Vibrations of Defects in Semiconductors: Importance of a 3-Body Interaction," March Meeting of the American Physical Society, Pittsburgh, PA (1994).

[28] S. N. Walck and W. B. Fowler, "Modeling Hydrogen Related Vibrations of Defects in Semiconductors," March Meeting of the American Physical Society, Seattle, WA (1993).

[29] S. N. Walck, X. Q. Wang, and J. Toulouse, "Raman Study of Precursor Effects in Li Doped $KMnF_3$ Near the 187K Phase Transition," March Meeting of the American Physical Society, Indianapolis, IN (1992).

PATENTS

[1] K. Dierenbach, E. G. Jacoby, D. A. Snavely, D. W. Tucker, and S. N. Walck, "Wallbox Electric Device Assembly," U. S. Patent 5,180,886 (1993).